The objective of the SMAP Cal/Val Program is to calibrate and validate Level 1 through Level 4 algorithms and products relative to the mission requirements. The overall strategy to meet this objective includes: (1) cold-sky and homogenous, stable Earth surface targets; (2) in-situ monitoring using ground-based observation networks; (3) intensive field campaigns using airborne sensors and ground-data acquisition; (4) comparative satellite-based soil moisture products; and (5) in-situ surface modeling. Spatial and temporal scaling techniques are utilized for data between satellite and in-situ observations. The Algorithm Theoretical Basis Documents (ATBD) will define the cal/val approach and requirements for each of the Level 1 through 4 data products.

SMAP-Cal/Val activities are divided into pre- and post-launch phases. Emphasis during pre-launch is on algorithm development and characterization of uncertainties (parameterizations and algorithmic implementation). During this phase the infrastructure and methodologies for post-launch validation will also be established. Emphasis during post-launch is on algorithm refinement and L1 through L4 product accuracy assessments over different regions and spatial and temporal time scales.

Methodology

The algorithms are calibrated and validated pre-launch using both simulated and experimental data. Global end-to-end simulations with representative land surface and observational conditions are performed to exercise all algorithms. The simulation results are compared to the real world by utilizing experimental data from field campaigns and actual satellites (e.g. SMOS). An Algorithm Testbed has been implemented on the SMAP Science Team for running the simulations. The Testbed also includes a Cal/Val Database that stores a wide range of experimental data. Establishment of procedures for timely transfer of required in situ data to the Cal/Val database will also define the pre-launch phase. Methodologies for up-scaling and validation measurements are described below.

Up-scaling and Validation Measurements

Several challenges exist in utilizing in-situ sensors for SMAP product validation. Not only do sensor measurement technologies vary among networks but also the installation of the sensors varies. To investigate these issues, an In-Situ Sensor Testbed activity was initiated by the USDA in Oklahoma in 2011. The Testbed will include an In-Situ Nitrogen Fixation study, and application of robust inter-sensor calibration methods. The thermo-gravimetric soil moisture sampling, will improve the reliability and consistency of the in-situ data record for SMAP product validation.

Several methods have been proposed for scaling point in situ measurements to satellite footprint scales. The SMAP Science Team will select the appropriate methodologies to be used for SMAP. An experimental Core Site list, accounting for up-scaling to SMAP grid resolutions, will be used to test and validate as well. In particular, the L1C product of the European Space Agency’s Sentinel-1 mission will be utilized to calibrate and improve the algorithms to yield the best possible products.